

Missing the Boat with Technology Usage in Early Childhood Settings: A 21st Century View of Developmentally Appropriate Practice

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Abstract Technology use permeates virtually all aspects of twenty-first century society, though its integration in early childhood settings and recognition as a developmentally appropriate practice remains problematic. A position is taken that education professionals may be ‘missing the boat’ by not embracing technology usage as a developmentally appropriate practice. Concerns are presented that both preservice education and inservice professional development require substantial improvement if early childhood education professionals are to both recognize the role of technology in developmentally appropriate practice and develop skills in using it in classroom settings.

Keywords Technology · Developmentally appropriate practice · Preservice education · Professional development

Seven year-old Latoya awakens to an alarm clock in the morning and hears the radio playing in the kitchen as her

mother prepares breakfast. She picks up a remote control on her nightstand and turns on her television to hear Sesame Street while she dresses for school. Her cell phone rings just before she goes to the kitchen, and her friend, Shannon reminds her that a new ‘pet’ at Webkinz.com is available. Latoya dashes to her family computer downstairs, logs on, and visits the Web site to see the new pet in the store catalog, and while there, uses KinzCash to buy new furniture for her current pet’s room. She sends her friend Shannon a message in KinzChat to ask if she wants to play a challenge game later in the day.

Later that day, Latoya’s younger brother Justin returns from his preschool and immediately logs onto his account at Kidzui.com, a Firefox extension that provides an internet environment designed for specifically for children. Clicking on a button to connect him to his MyKidzui page, he pings several friends to say ‘hi’, watches as they come online, and is delighted to see points awarded to him when he shares some ‘cool’ websites that he has tagged. Since his teacher conducted a lesson on tiger sharks, Justin wanted to see some sharks in their natural environments. Justin clicks on the Kidzui search feature and types the first few letters of the word ‘shark’. Bars appear with options: ‘sharks’, ‘shark tales’, ‘shark coloring page’, ‘tiger sharks,’ and ‘sand sharks.’ Each bar is connected to Websites having video and other resources to help Justin gain more information.

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Role of Technology in Today’s World

In the classic children’s book, *The Wind in the Willows* (Grahame 1908) a conversation between the Mole and Rat ensues in the opening pages of the novel. The Mole declares that he has “never been in a boat before in all my life,” to which the Rat responds incredulously “what have

you been doing, then?” The Mole then follows with a query, “Is it so nice as all that?” Which then brings a response from the Rat: “Nice? It’s the *only* thing...Believe me...there is *nothing*—absolutely nothing—half so much worth doing as simply messing about in boats”.

An analogy to the role of technology in contemporary society may certainly be drawn here. As illustrated in the preceding vignettes, young children live and participate in twenty-first century daily life activities that are permeated with the presence of a wide range of technologies (Parette et al. 2008a). In fact, our world has changed so markedly in recent decades with regard to the use and impact of technology, that more than 10 years ago Conn (cited in Tapscott 1998) observed that technology is “like the air” (p. 39) for the current generation of children. While it’s not the ‘only’ thing, as the Rat might suggest when discussing boats, it is certainly an important thing, and early childhood educators may indeed be ‘missing the boat.’ As noted by Silver-Pacuilla (2006) there has been a “stunning innovation of technology; it has become easier to use and customize, more powerful and robust, and available at lower costs, making it attractive as part of a school-wide solution [to facilitate learning among students, *emphasis added*]” (p. 11). Such technology innovations have increasingly gained presence in the delivery of educational experiences (Loveless and Dore 2002; McGee and Richgels 2006; Peterson-Karlan and Parette 2008; Stephen and Plowman 2003), particularly for young children in some early childhood settings (Blum et al. 2009; Parette et al. 2009a, b, 2008a). Although the use of technology in early childhood classrooms and home settings has increased markedly over time (Judge 2006; Plowman et al. 2009; Rosen et al. 2007; Rosen and Jaruszewicz 2009; Weinberger et al. 2009; Zevenbergen 2007), many early childhood classrooms are still lacking in utilization of developmentally appropriate technology methods (Davis et al. 2007; Judge 2006; Wilcox et al. 2006a, b), often due to a variety of concerns about technology’s role in the early childhood curriculum (Finnegan and Austin 2002; National Association for the Education of Young Children 1996; Plowman et al. 2009; Wardle 2008).

Outside of school, children frequently use technologies in their play experiences with commercially acquired toys and related learning materials (e.g., Barbie Digital camera; intelligent toys [<http://www.brainwavestoy.com/3-5-years-c-145.html>]); through interactions with entertainment media (e.g., mp3 players, iPods®, game sites, television [e.g., <http://kids.yahoo.com/games>; Kirkorian et al. 2008]); and for communication with others (i.e., information and communication technologies [ICT], such as cell phones and Internet Web sites e.g., Kidzui.com). Young children are also exposed to and use computers and related technologies frequently in their homes (Downes 2002; Jewitt 2006; Loveless

and Dore 2002; McGee and Richgels 2006; Parette et al. 2008a, b; Plowman et al. 2009; Siraj-Blatchford and Whitebread 2003), and observe their family members and others using various technologies in a cadre of ways in daily life activities. Such experiences provide powerful models for technology use while also shaping the changing profile of our technology-based culture. Blum et al. (2009) have called this transformation a “cultural *zeitgeist*” (p. 41), or trend, in which technology use is an accepted and natural part of children’s lives. Such home experiences have been shown to support ‘emergent literacy’ skill development (Casey 2000; McGee and Richgels 2006; Stephen and Plowman 2003) and set the stage for the acquisition of higher level literacy skills.

The use of technology by young children in home and community settings may influence children’s early literacy no less than any other purposeful learning (New 2001). Recognizing that there is wide variability across family settings with regard to specific technology applications available to young children, the issue is not, however, whether technology should be considered and used in education settings but how and whether it *makes a difference* in children’s learning and development (Anderson et al. 2008; Judge 2006; Loveless and Dore 2002; Wilcox et al. 2006a, b). As Loveless and Dore observed, “teachers...are working with pupils who are growing up with ICT [information and communication technology, *emphasis added*] as a non-remarkable feature of their world, in the same way as an earlier generation took television for granted” (p. xi). Many of these technologies that are non-remarkable hold the potential to shape children’s learning are, in fact, *readily available* (Parette et al. 2009a, 2008a). These readily available technologies have been increasingly demonstrated to have real potential for learning, particularly in helping children develop emergent literacy skills (Meadan et al. 2008; Parette et al. 2009a, b).

Interestingly, technology applications are still used less frequently in early childhood education settings than may be the case in real world settings (Parette and Stoner 2008). The disconnect between technology use in early childhood and home settings was succinctly summarized by Parette et al. (2008b) who observed, “Within school cultures, substantive differences often exist between skills that are taught and valued in the schools and skills that are valued in the larger society” (p. 153). Quite frequently, a visitor in many early childhood settings might think that young children were asked ‘to leave their technology at the door’ before entering the classroom. Cell phones and other communication applications, computers and other tools may not be allowed by education professionals who use traditional teaching approaches and materials, and who may not understand how current technologies may be used to support the growth and learning of young children.

Importance of Digital Literacy Skills in 21st Century Education Milieus

The importance of preschool education in the development of foundational literacy skills to support children's learning for a lifetime is well-recognized (Dickinson and Neuman 2006). Zammit and Downes (2002) have argued that an understanding of literacy must include 'multiliteracy', or a more diverse set of texts and technologies, such as those currently advocated by various twenty-first century education organizations advocating for systemic change in the U.S. (International Society for Technology in Education 2007; Partnership for 21st Century Skills 2007, 2008, 2009b).

Early childhood education settings develop necessary foundational skills required for children to (a) successfully transition into public school settings, (b) participate effectively in the curriculum, and (c) demonstrate achievement in key content areas. Among these important skills are emergent literacy (e.g., phonemic awareness, word recognition, concepts about print, alphabetic principle, and comprehension); basic math concepts (National Association for the Education of Young Children [NAEYC] and the National Council of Teachers of Mathematics [NCTM] 2002); play (Cook et al. 2008; Miller and Almon 2009), and socialization (Katz and McClellan 1997). In fact, the No Child Left Behind Act of 2001 (NCLB) emphasizes school accountability for student achievement in foundational core subjects. Key foundational skills for success in these core subject areas are developed in the early childhood years, though in today's world the way in which education professionals approach their development with young children should be viewed through the lens of rapidly changing, technology-based, twenty-first century society. As noted by the Partnership for Century Skills (2002): "the world in which students live has changed ...The explosion of powerful technology... demands a drastically different set of skills. Rapidly evolving technologies have made new skills a requirement for success in everyday life." (p. 6).

These skills, or basic technology literacy competencies, lie along a continuum and range from simple uses of technologies in daily life activities to complex problem-solving applications (International ICT Literacy Panel 2002). As an initial response to such demands, NCLB has required that, in addition to core subject competence, students must be proficient in technological literacy by the 8th grade, but education for the world as it is evolving requires more than basic competence. Together with new models for learning, new skill sets have been defined that are needed by students to achieve success in the information age (International ICT Literacy Panel). At the core of these twenty-first century skill sets are needs for students to learn to use lifelong learning skills together with technology tools.

Teacher Preparation and Technology Use: Cultural Transition Issues

In a 1996 position statement by the National Association for the Education of Young Children (NAEYC), it was noted that: "Choosing appropriate software is similar to choosing appropriate books for the classroom—teachers constantly make judgments about what is age appropriate, individually appropriate, and culturally appropriate." This statement places a great deal of responsibility on the early childhood teacher to, "critically examine the impact of technology on children and be prepared to use technology to benefit children" (NAEYC 1996, p. 1). Although this statement provides some guidance and direction related to the appropriate utilization of technology in early childhood settings and outlines ways in which technology can be built into preservice and inservice professional development opportunities for early childhood educators, more than a decade later, we still are not seeing significant advances in the utilization and implementation of technology in early childhood settings. The NAEYC position statement, however, has in recent years been reexamined to place greater emphasis on the role of technology in the curriculum (Dever and Falconer 2008).

Not surprisingly, a 3-year examination of early childhood teacher preparation practices (Laffey 2004) found that while preservice teachers may envision using technology in their classrooms in the future, in practice there is resistance to use of technology for the delivery of instruction given that it is often perceived to 'interfere' with their relationship with children. This perception may hold questionable validity now given the increasing use of social networking sites such as Facebook and MySpace, and, more recently through children's social networking sites such as Kidzui™. Now more than ever we are finding a way for this 'third space' to exist where children are able to develop and maintain relationships through face-to-face and/or cyber interactions. Barriers also exist in the unknown (Jenkins et al. 2009). For example, many teachers and program administrators share in nationwide concerns regarding predatory behavior toward children, which has resulted in such sites developing stricter guidelines and monitoring use (Feldman 2008; Huffman 2008; Stone 2008). When used appropriately, these sites can be powerful socialization models for children to develop relationships with others. Their use also reflects cultural transitions occurring regarding the nature and use of technology tools in children's daily lives. More generally, other challenges exist, including continuing negative teacher attitudes toward technology use (Hutinger et al. 2006), and limited research regarding specific technology applications and their effectiveness (Floyd et al. 2008; Lank-shear and Knobel 2003).

Clearly a greater emphasis on the appropriate use of technology in early childhood settings is needed, particularly in early childhood teacher preparation programs. When conducting an informal review of early childhood textbooks archived in Illinois State University's library holdings in early childhood education, only a small number of university-level textbooks had any content related to either instructional or assistive technology applications and the curriculum for young children, either with or without disabilities. Further, when examining the courses offered in 23 early childhood education programs in the United States only two of these programs offered courses specifically designed for early childhood teachers. Titles for these courses included, *Technology and the Young Learner* and *Computer Utilization for Early Childhood Teachers*. Upon further investigation, seven additional universities required more general courses for use of technology in educational settings, with titles of courses like, *Technology in Education*. Therefore, 13 of the 23 programs did not require any courses related to technology utilization in the classroom.

What is most troubling about this is that we as an American society are still not focusing on the importance of teaching appropriate uses of technology in early childhood settings even though there are both national and international frameworks, or *macro cultures*, of technology use and recommended standards across societies and states (cf. International Society for Technology in Education 2007; North Carolina Newspapers in Education 2009; Partnership for 21st Century Skills 2009). The emergence and growth of these cultural groups reflects a global transition toward reliance on and increased use of technology. However, within such broad macro cultures and their related core values and belief systems, there are also many *micro cultural* groups (e.g., race, ethnicity, nationality, language, social status, rural/urban, disability, education service systems), each participating to varying degrees in the global (and national) technology macro culture while also retaining to differing degrees elements of their respective micro cultural traditions (Kalyanpur and Harry 1999; Puckett and Black 2005).

Education entities, particularly public schools, have been recognized for decades as being distinct cultural entities having values, behaviors, and characteristics that reflect profiles of communities within which they reside (Goodlad 1984; Rossman et al. 1988; Thomas and Loxley 2001; Welch 1989). Inherent in the cultural characteristics of schools is the instinctive resistance to change, resulting in the educational establishment remaining in essence unchanged since the late ninetieth and early twentieth century (Casey 2000). This resistance to change is certainly true of schools embracing the role and use of technology in modern day classrooms (International Society for Technology in Education, Partnership of 21st Century Skills,

and State Educational Technology Directors Association 2009; Jewitt 2006; Loveless and Dore 2002).

Parette et al. (2008b) observed that both family members and early childhood education professionals may align themselves with professional or 'personal interest groups' having their own unique values and rules regarding membership and participation (e.g., public schools; parent organizations). They then participate in these varying groups to less or greater extent based on the extent of meaningful socialization and interactions that occur (Banks 1997a, b). Sleeter and Grant (2003) have observed that the extent of cultural continuity between homes and schools often varies markedly, and can have a variety of effects on children's learning (Pheelan et al. 1991). This certainly may be true regarding technology use in homes vs. early childhood settings, and is further complicated by both generational differences (Peterson-Karlan and Parette 2005) and the past experiences with technology of specific individuals (Parette and Stoner 2008).

Getting in the Boat: Reconceptualizing Developmentally Appropriate Practice

Sensitivity of teachers to cultural changes is deeply embedded in the philosophy of developmentally appropriate practices with young children (NAEYC 1995, 2009). In a position statement regarding the role of cultural sensitivity, the NAEYC stated: "early childhood programs are responsible for creating a welcoming environment that respects diversity, supports children's ties to their families and community, and promotes both second language acquisition and preservation of children's home languages and cultural identities" (p. 1). Arguably, both family settings and communities have changed in the intervening years since this statement was made, and its meaning and application to a culture replete with increased technology use should be addressed. The use of technology in many family settings is now evident, and its acceptance and importance in the micro cultures of communities across the U.S. is certainly well-recognized (Bakken and Parette 2006; Plowman et al. 2009).

Therefore, we in the field of early childhood education must become strong advocates for embedding meaningful, developmentally, and culturally appropriate uses of technology into our teacher preservice and inservice training so that teachers better understand the importance of infusing technology into instructional strategies. No longer can we hide behind barriers of time constraints and a lack of fiscal resources. While these can be challenges, there are certainly ways to overcome these challenges through grant-writing, collaborations with local agencies, and donations of equipment that can turn challenges into opportunities.

Truly what is needed is a change in attitude toward the use and application of technology in the classroom so that technology is seen as an integral component of developmentally appropriate practice for young children.

Admittedly, teacher attitudes regarding technology that are generationally based may be difficult to change. Guskey (2002) found that teachers' attitudes do not change until they have seen in practice that a theory or instructional strategy will work. To address this need for teacher supports and experiences in using technology, Parette and Stoner (2008) reported that professional development (i.e., user groups) is critical to help develop both operational and functional competence among early childhood teachers to use classroom technologies effectively. Similarly, Head Start teachers have developed effective computer skills and integrated this technology more efficiently when carefully designed professional development was provided (Chen and Price 2006). Once familiarity with technology is developed, along with opportunities to use it in classroom settings repeatedly, positive outcomes with children may be anticipated (cf. Blum et al. 2009; Parette and Stoner 2008), presenting the field with compelling support for use of such research-based strategies in our teacher preparation programs (e.g., Bausch and Hasselbring 2004; Wojcik et al. 2004) and professional development opportunities provided to early childhood teachers.

Mary Anne begins her day by booting up her computer and reviewing the data on her student performance using the Ready-to-Go curriculum (Blum and Watts 2008) from the previous day. Her reports indicate that as a result of using both Microsoft® PowerPoint™ templates, coupled with direct instruction that are components of the research-based curriculum, Mary Anne's students have been acquiring key phonemic awareness skills at a faster rate than in previous years. Her students arrive and gather on the carpet to see what curriculum learning templates are being projected on the wall screen by an LCD system. Mary Anne quickly creates some student visual response cards using Boardmaker® with Speaking Dynamically Pro® (Mayer-Johnson 2008) and prints them using a color printer in her classroom. Four cards are distributed to each student so that they can select pictures of words (ball, pen, cat, dog) with beginning sounds presented ('b', 'p', 'c' and 'd') using the curriculum templates. When she begins her 7-min lesson, the PowerPoint™ slides are sequentially presented, and Mary Anne uses scripted directions and prompts to teach the targeted skills (see Parette et al. 2009a; Parette et al. 2008a). After the lesson is taught, she opens the software application Clicker 5 (Crick Software 2007), a grid writing program used widely in education settings to support literacy activities (Parette et al. 2009b), and presents sequences of writing choices (e.g., beginning words in sentence, verbs, objects) from which students can choose. As selections are called out by the

students, the text appears in a screen, helping children develop an understanding of concepts about print. Mary Anne then reads to students using a PowerPoint™ 'talking book'—based on the children's book the Very Hungry Caterpillar—that she has created, which embeds animation, an audio recording of her voice, and opportunities for children to predict what happens next, followed by reinforcing animation and sound.

As illustrated in this vignette, an array of technologies may potentially be considered in the context of developmentally appropriate practices in early childhood settings. Also presented in Table 1 are other examples how research-based practices have technology solutions appropriate for early childhood classroom settings. In each instance, a practice area is followed by a general technology solution along with 'Techno Tips' to facilitate implementation.

But use of such tools cannot be expected unless teacher education programs and professional development practices change in recognition of twenty-first century young learners and technology practices both in home and community settings. We believe, based on experience, that teachers need curricular and instructional competence with technology, *in addition* to functional and operational competence (Parette and Stoner 2008; Parette et al. 2009c). In describing teacher success in implementing technology successfully, Blum et al. (2009) found that early childhood teachers needed to (a) understand *how to use* research-based instructional strategies (b) understand *why* a specific technology tool was important to young children (curricular competence); (c) demonstrate ability to use *the technology tool/s* (operational competence); and (d) apply the *technology tools* in the classroom (functional competence). It is this 'group' of skills that lead to comprehensive educational technology competence that underpin developmentally appropriate practices. Without all four competencies, we are likely to see inadequate uses and unsustainable technology practices in the field of education. Both preservice education and inservice professional development require substantial improvement in all four areas so that early childhood education professionals can develop and integrate them into developmentally appropriate classroom practices. A preservice education program in particular cannot simply provide a single instructional technology class with the expectation that they have provided what their students need to serve young children in developmentally appropriate ways. Full integration of technology into the teacher preparation curricula is needed so that early childhood programs have professionals who are adequately prepared on exiting the programs.

Our society has become more dependent on technology in virtually all aspects of modern day life, yet early childhood settings still lag substantively behind in embracing the potential of a vast cadre of new and

Table 1 Selected effective practices, technology solutions, and tips for implementing solutions

Effective practice	Early childhood technology solution	Tech tips
Emergent literacy skills: phonological awareness	Templates in <i>PowerPoint™</i> may be created that follow a lesson structure including modeling, guided practice, corrective feedback, and assessment	The teacher: Selects clip art that is concrete and familiar to the child. It is best for the teacher to model the skill
	Clip art and animation features in <i>PowerPoint™</i> may be used versus printed cards	For example, a picture of a 'bear' appears on the screen using the animation feature in <i>PowerPoint™</i> . The teacher should model "bear" begins with/b/."The children should repeat it numerous times with the 'bear' repeatedly flashing on the screen
	Project lesson template may be projected onto a large screen using an LCD projector for a large group activity or small group activity center	Listens for errors, gives corrective feedback, and assesses performance by showing multiple pictures on the screen. The children may be asked, "Which picture begins with/b/?" or "What sound does the picture make?" (see http://people.coe.ilstu.edu/cblum/RTG/homertg.htm)
Social skills instruction: teaching behavioral expectations	Quick cams may be used to help young children identify socially appropriate behavior	Should be positive and use videos as 'teachable' moments
	Digital videos may be made of children on the playground, during physical education time, or during a classroom activity; children can watch the videos of themselves	Should not focus on a single child who misbehaves as the 'non-example'
Child focused instructional strategy: problem solving in the community	Children can be asked to identify both desirable and undesirable behaviors and connect these behaviors to school-wide, program wide, or classroom expectations	Should recognize and reinforce positive behavior and connect it back to teaching the expectations presented on the digital video
	A visual picture book of an upcoming field trip or regular outing can be created	Can add new pictures to the show once the field trip or community outing has occurred, and stimulate vocabulary development by having students talk about experiences
	The teacher can initially create digital pictures, or download from the Internet, representing the types of experiences children will encounter	Incorporate pictures of children (who enjoy seeing themselves)
	Pictures can be embedded in <i>Clicker 5</i> or <i>PowerPoint™</i> and students allowed to preview. <i>Clicker 5</i> is useful to record one's voice as part of the slide show. While viewing the slide show, the teacher can pose a problem to the class or group of students, e.g., "Who would you go to if you were lost?"	Save shows developed to share with parents throughout the year
	The teacher can use clip art to facilitate solutions to the problem and discuss both good and poor solutions	Add a writing component by letting children brainstorm, with the teacher writing words on the screen

powerful learning tools. We are optimistic that change will indeed occur—or ‘getting in the twenty-first century boat’—as the early childhood discipline embraces the challenge of reconceptualizing the role of technology in developmentally appropriate practice. In so doing, educators will increasingly acknowledge, as the Mole did, “What a day I’m having!...Let us start at once!”

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